Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Role of Compressibility on the Shedding Dynamics of a Cavitating Wake[1] HARISH GANESH, JULIANA WU, DANIEL KNISTER, STEVEN CECCIO, University of Michigan — Cavitation dynamics in wakes behind bluff bodies is known to be strongly dependent on the inlet cavitation number, for a given Reynold's number. The cavity shedding frequency of a cavitating wake increases with a decrease in inlet cavitation number, to attain a peak, and decrease again with a further reduction in inlet cavitation number. The physical mechanism of this observed trend in the shedding frequency is yet to be fully understood. High-void fraction bubbly cavitating flows observed in separated liquid flow regions can have low speed of sound within the bubbly mixture. The effect of compressibility of such a bubbly mixture on the underlying cavity dynamics can be important and is explored in the current study. By performing Proper Orthogonal Decomposition (POD) of X-ray densitometry-based time-resolved void fraction flow fields of the cavitating wake, it is shown that the type of the mode observed and its energy content depends on the inlet cavitation number. At higher cavitation numbers, a sinusoidal mode is observed as a dominant mode, while a pulsating mode, in addition to the sinuous mode, becomes increasingly dominant when approaching the peak shedding frequency. The appearance of this observed pulsating mode is similar to that observed on single-phase compressible wakes reported in literature. Upon non-condensable gas injection into the base flow it is verified that the observed modal patterns are strongly dependent on the compressibility of the mixture.

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Date submitted: 31 Jul 2019 Electronic form version 1.4